

IN THE CLAIMS:

Cancel Claim 1.

Add the following new Claims 24-47:

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-- 24. A triple lumen vascular access catheter capable by advancement along an insertion guide wire of percutaneous entry into a blood vessel of the cardiovascular system of a patient, said catheter comprising:

- a. an outer tube having a proximal end and a distal end;
- b. an inner tube having a proximal end and a distal end and defining therewithin a first lumen, said inner tube having an outer diameter less than the inner diameter of said outer tube, said inner tube being disposed within said outer tube to define an interior space between the outside of said inner tube and the inside of said outer tube, the inner diameter of said inner tube being so sized as to accommodate an insertion guide wire having an outer diameter in a range from about 0.036 inches to about 0.038 inches;
- c. a first septum extending from a first point on the outside of said inner tube to a first point on the inside of said outer tube;
- d. a second septum extending between a second point on said outside of said inner tube and a second point on said inside of said outer tube, said first septum and said second septum thereby separating said interior space into a second lumen located on one side of said first septum, said inner tube, and said second septum, and a third lumen located on the opposite side of said first septum, said inner tube, and said second septum;

e. a tapered distal tip section at said distal end of said outer tube, the outer surface of said distal tip section tapering radially inwardly from said distal end of said outer tube toward said inner tube and terminating in a first aperture through which said first lumen communicates with the exterior of said distal tip section;

f. a second aperture formed through said outer tube proximate said distal end thereof, said second lumen communicating with the exterior of said outer tube through said second aperture; and

g. a third aperture formed through said outer tube proximate said distal end thereof, said third lumen communicating with the exterior of said outer tube through said third aperture.

25. A catheter as recited in Claim 24, wherein the size of said inner diameter of said inner tube is about 0.04 inches.

26. A catheter as recited in Claim 24, wherein the distance between said first point on said outside of said inner tube and said first point on said inside of said outer tube is equal to the distance between said second point on said outside of said inner tube and said second point on said inside of said outer tube.

27. A catheter as recited in Claim 26, wherein said first septum and said second septum are coplanar.

28. A catheter as recited in Claim 26, wherein the transverse cross section of said second lumen is congruent with the transverse cross section of said third lumen.

29. A catheter as recited in Claim 28, wherein each of said second lumen and said third lumen have a C-shaped transverse cross section.

30. A catheter as recited in Claim 28, wherein each of said second lumen and said third lumen have a D-shaped transverse cross section.

31. A catheter as recited in Claim 24, wherein said outer surface of said outer wall of said distal tip section tapers continuously from said distal end of said outer tube to said first aperture.

32. A triple lumen catheter comprising:

a. a catheter body comprising:

- i. an outer tube having a proximal end and a distal end;
- ii. an inner tube having a proximal end and a distal end and defining therewithin a first lumen, said inner tube having an outer diameter less than the inner diameter of said outer tube, said inner tube being disposed within said outer tube to define an interior space between the outside of said inner tube and the inside of said outer tube;
- iii. a first septum extending from a first point on the outside of said inner tube to a first point on the inside of said outer tube;

iv. a second septum extending between a second point on said outside of said inner tube and a second point on said inside of said outer tube, said first septum and said second septum thereby separating said interior space into a second lumen located on one side of said first septum, said inner tube, and said second septum, and a third lumen located on the opposite side of said first septum, said inner tube, and said second septum; and

b. a tapered distal tip section at said distal end of said outer tube, said distal tip section comprising:

i. a cylindrical central extension having an outer diameter less than the outer diameter of said outer tube and enclosing a third passageway, said central extension having a proximal end secured to said distal end of said inner tube in fluid communication with said first lumen and a distal end terminating in a first aperture through which said first lumen communicates by way of said fluid passageway with the exterior of said distal tip section; and

ii. a shoulder between said distal end of said outer tube and said proximal end of said central extension smoothly and continuously interconnecting the outer surface of said second tube with the outer surface of said central extension.

33. A catheter recited in Claim 32, wherein the inner surface of said cylindrical extension is smoothly and continuously connected to the inner surface of said inner tube at said distal end thereof.

34. A catheter as recited in Claim 32, wherein the area of the transverse cross section of said first lumen is equal to the area of the transverse cross section of said fluid passageway in said central extension.

35. A catheter as recited in Claim 32, wherein said shoulder of said distal tip section tapers radially inwardly in a circularly symmetric manner from said distal end of said outer tube into engagement with said cylindrical central extension.

36. A catheter as recited in Claim 35, further comprising:

a. a second aperture formed through said outer tube proximate said distal end thereof, said second lumen communicating with the exterior of said outer tube through said second aperture; and

b. a third aperture formed through said outer tube proximate said distal end thereof, said third lumen communicating with the exterior of said outer tube through said third aperture.

37. A catheter as recited in Claim 36, wherein said second aperture is located further from said first aperture than said third aperture.

38. A catheter as recited in Claim 36, wherein a solid insert fills each of said second lumen and said third lumen distal of said second aperture and said third aperture, respectively.

39. A catheter as recited in Claim 36, wherein a plug terminates each of said second lumen and said third lumen distal of said second aperture and said third aperture, respectively.

40. A catheter as recited in Claim 32, wherein the material of said cylindrical central extension exhibits physical characteristics different from the physical characteristics of the material of said outer tube.

41. A catheter as recited in Claim 40, wherein said material of said cylindrical central extension is softer than said material of said outer tube.

42. A triple lumen catheter comprising:

a. a catheter body comprising:

- i. an outer tube having a proximal end and a distal end;
- ii. an inner tube having a proximal end and a distal end and defining therewithin a first lumen, said inner tube having an outer diameter less than the inner diameter of said outer tube, said inner tube being disposed within said outer tube to define an interior space between the outside of said inner tube and the inside of said outer tube;
- iii. a first septum extending from a first point on the outside of said inner tube to a first point on the inside of said outer tube; and
- iv. a second septum extending between a second point on said outside of said inner tube and a second point on said inside of said outer tube, said first septum

and said second septum thereby separating said interior space into a second lumen located on one side of said first septum, said inner tube, and said second septum, and a third lumen located on the opposite side of said first septum, said inner tube, and said second septum;

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b. a circularly symmetric frustoconical distal tip section at said distal end of said outer tube, the outer surface of said distal tip section tapering radially inwardly from said distal end of said outer tube toward said inner tube and terminating in a first aperture at the apex of said distal tip section, said first lumen communicating with the exterior of said distal tip section through said first aperture;

c. a plurality of second apertures formed through said outer tube proximate said distal end thereof, said second lumen communicating with the exterior of said outer tube through said plurality of second apertures;

d. a plurality of third apertures formed through said outer tube further from said distal end thereof than said plurality of said second apertures, said third lumen communicating with the exterior of said outer tube through said plurality of third apertures; and

e. access means attached to said proximal end of said outer tube and said proximal end of said inner tube for affording fluid communication individually with said first lumen, said second lumen, and said third lumen.

43. A catheter as recited in Claim 42, wherein said access means comprises:

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- a. a connector attached to said proximal end of said outer tube and said proximal end of said inner tube;
 - b. a first access tube attached to said connector and communicating therethrough with said first lumen;
 - c. a second access tube attached to said connector and communicating therethrough with said second lumen; and
 - d. a third access tube attached to said connector and communicating therethrough with said third lumen.

44. A catheter as recited in Claim 43, further comprising:

- a. cylindrical attachment fitting rotatably mounted on the exterior of said connector; and
- b. a pair of coplanar suture wings extending laterally from opposite sides of said attachment fitting.

45. A catheter as recited in Claim 43, wherein said first access tube carries a closure clamp.

46. A method of manufacturing a triple lumen catheter, said method comprising the steps

of:

- a. extruding a catheter body having a circular transverse outer cross section, said catheter body enclosing a longitudinally extending first lumen and a longitudinally extending second lumen separated by a generally planar septum having a bulbous middle portion projecting from one side of said septum into a said first lumen and from the other side of said septum into said second lumen;
- b. forming a third longitudinally extending lumen within said bulbous portion of said septum;
- c. tapering the outer wall of said catheter body inwardly at the distal end thereof into engagement with said bulbous portion of said septum;
- d. terminating each of said first lumen and said second lumen proximal of said distal end of said catheter body; and
- e. forming a first side opening through the outer wall of said catheter body to said first lumen;
- f. forming a second side opening through the outer wall of said catheter body to said second lumen.

47. A method as recited in Claim 46, further comprising the step of extending said bulbous portion of said septum with said third lumen therein distally beyond said outer wall of said catheter body. --